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MICA IN WYOMING

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Contents

Introduction

The term *mica* refers to a group of platy minerals that include muscovite, biotite, phlogopite, and others. Muscovite and phlogopite are the only members of this group that are economically important as industrial minerals. Biotite, a common rock-forming mineral that is sometimes found in large crystals, has no economic value at the present time, nor was it important in the past. Commercially, muscovite is by far the most important mica, both for past and present production. Sericite is muscovite characterized by a distorted platy crystal structure and occurring in fine grain sizes (Chapman, 1983).

Economic uses of mica

The crystal structure of the mica minerals allow them to be split into very thin sheets. Muscovite sheets are durable and transparent, and have valuable dielectric and insulating capabilities. There are several categories of commercially produced mica. *Sheet mica* is muscovite that has been split into large enough sheets so that it can be cut, punched, or stamped into specified shapes and sizes. *Punch mica* is an archaic term for a kind of sheet mica produced to be cut by a punch into various shapes. *Scrap and flake mica* are small mica particles that used to be the waste products from the processing of sheet mica. Now (1989), scrap and flake mica constitute most of the domestic mica production. In the past, phlogopite made up a minor amount of scrap and flake mica production. *Built-up mica or micanite* is sheet mica in which several sheets of different crystal orientation are stacked together and pressed into a single sheet at high temperature. The overlapping structures give these sheets greater strength (Chapman, 1983).

Historically, mica was used for glazing stove windows, doors, lanterns, lamp chimneys, and lampshades. Only sheet mica was used for this purpose, and the sheets had to be large enough to cover the opening (Gwinn, 1951).

With the advent of the electrical industry and the development of improved additives to other industrial products such as paint and rubber (Gwinn, 1951), and later the development of the electronics industry, scrap and flake mica became important products. The main uses of ground scrap and flake mica are in joint cement, as a filler and additive to paint, in roofing material, as an additive to oil well drilling fluids, and as a filler in rubber products.

In addition to increasing use in electronic components, there is an increasing demand for ground mica for paint and decorative facing material. Slightly colored varieties of muscovite are now in more demand. Rose-colored mica is especially favored.

Production

In 1988, only about 500 pounds of sheet mica were produced. However, 2,200,000 pounds of sheet mica were consumed by electronic and electrical equipment manufacturing companies in the United States. This mica came from domestic government stockpiles of sheet mica (Davis, 1989a).

In 1988, 267,000 short tons of scrap and flake mica were produced in the United States. Of this total, 147,000 short tons came from mine production. The remaining 120,000 short tons came from the waste products from processing stockpiled sheet mica (Davis, 1989b).

Sixty-one percent of U. S. mica is produced in North Carolina. Other mica-producing states are Connecticut, Georgia, New Mexico, Pennsylvania, South Carolina, and South Dakota (Davis, 1989b). In 1988, the production of sericite was 31,000 short tons, and this material was used in brick manufacture (Davis, 1989b).

The production of scrap and flake mica is expected to slowly increase (Davis, 1989b). The production of sheet mica has remained constant since 1982 (Davis, 1989a). Sheet mica production should remain small until the government stockpiles are depleted.

There was a large mica mining industry in the U.S. in the years before the early 1950s. Since then, production has fallen as substitute materials have replaced sheet mica, particularly in transparent insulating windows. Recently, there has been an increase in the number of inquiries to the Geological Survey of Wyoming about sheet, scrap, and flake mica. Many of these inquiries have been from far-eastern countries.

Mica occurrences in Wyoming

The few occurrences of mica in Wyoming, including phlogopite, may be economic to mine for export if a market can be established and if enough mica is present in the occurrences.

In Wyoming, mica is most often found in mineable quantities in pegmatites. Sericite deposits are found in Precambrian schists. The principal areas that have muscovite-bearing pegmatites in Wyoming are the Medicine Bow Mountains, Sierra Madre, northern Laramie Mountains, and the Hartville uplift (see map, **Figure 1**). Phlogopite occurrences are found in Fremont and Sweetwater Counties. The following section is a description of the principal mica occurrences in Wyoming. Numbers preceding each description refer to the locations on the map (**Figure 1**).

Albany County

1. Ione, Muscovite, George-Funk Mica, Funk Mica, and Many Values prospects
   Sec. 32, T.13N, R.78W

Beckwith (1937) reported that at least three granite pegmatite dikes were found on the Ione and Muscovite claims. Muscovite forms books up to a foot wide in zones up to 100 feet across in these pegmatites. Other reported minerals include albite-orthoclase feldspar and microcline, green beryl, black tourmaline (schorl), a yellow-brown garnet, and an unidentified greenish yellow powdery mineral. Beckwith (1937) also reported tantalite-columbite in the Ione pegmatite.

The total production from this group of prospects before 1942 was reported by Hanley and others (1950) to be 36,600 pounds of scrap mica, 2500 tons of punch mica, and 500 pounds of rifted sheet mica.

Hagner (1942) reported that a pegmatite called the Many Values prospect was opened in the early 1940s for a distance of 110 feet, with an average mined width of 8 feet. A small tonnage of iron-stained mica was stockpiled. Some of the mica was in flakes several inches across, and the amount of iron staining decreased with depth (Hagner, 1942). George (1942), reports that 12 tons of "grinding mica" (probably flake mica) and 2500 pounds of punch mica were shipped to Denver and that 500 lbs. of "rifted sheet" and 6 tons of "grinding mica" were shipped to South Dakota from this group of prospects.

Another prospect in this area was opened by a 30 feet by 10 feet pit 4 feet deep. (Hagner, 1942b) This pegmatite consists of microcline and quartz with small quantities of scrap mica present. Hagner (1942) called this prospect the Funk prospect. It is also known as the George-Funk mica prospect.

2. Big Chief Mica
S1/2, S1/2 Sec. 16, T.25N, R.71W

Pink muscovite crystals up to several inches in diameter were reported by Hagner (1943), in a pegmatite that also contained black tourmaline, graphic intergrowths of feldspar and quartz, biotite, and a narrow zone of vermiculite. Before 1943, a shaft was sunk on the pegmatite to a depth of 15 feet. This shaft connects with a 60-foot-long cut that extends in a N60°E direction from the shaft (Hagner, 1943). Pink scrap and flake mica are currently in demand as decorative additives to many products.

Albany and Laramie Counties

3. Southern Laramie Mountains
T.13, 14, 15, 16, and 17N, R.70, 71, and 72W

Simple pod-shaped quartz-feldspar-biotite pegmatites are abundant in the southern Laramie Range. Some of the biotite books found in these pegmatites are 15 feet in diameter and 1 foot thick (Harris and Hausel, 1986). This mica has no present economic value.

Carbon County

4. Baggot Rocks
Sec. 9, T.15N, R.83W

Hoag (1927) reported that a number of mica deposits were found in this area. These occur in quartz-feldspar-muscovite pegmatites. Analyses of the micas show : silica = 36% - 60.5%; ferric oxide = 3.92% - 10.23%; aluminum oxide = 10.46% - 23.88%; calcium oxide = 0.8% - 9.34%; magnesium oxide = 9.05% - 25.89%; alkalies = 4.18% - 9.35%; and loss on ignition = 0% to 0.67%. (Hoag, 1927).

5. Big Creek area
Secs. 6, 7, 18, 19, and 30, T.13N, R.80W, and secs 1-30, T.13N, R.81W

Granite pegmatites are found throughout this area. The most common type is an unzoned feldspar-quartz pegmatite containing accessory biotite, garnet, muscovite, magnetite, and ilmenite. A second type is more complex mineralogically, and contains feldspar, quartz, garnet, tourmaline, biotite, muscovite, and fluorite, with other accessory

minerals (Houston, 1961). No estimate of the quantity and quality of the mica in this area is available.

Converse County

6. Unnamed prospect
Sec. 24, T.32N, R.75W

A quartz-feldspar-muscovite pegmatite is found at this location. Beryl is a minor constituent of the pegmatite. Two pits are present on the property, which was mined in the past for feldspar. No estimate of the amount of muscovite is available (Smith, 1953).

Crook County

7. Mineral Hill area
Secs. 21, 28, and 33, T.51N, R.60W

Large quartz-feldspar-muscovite pegmatites extend into these sections from the Tinton District, most of which is in adjacent South Dakota. Muscovite is a major constituent of these pegmatites, sometimes composing 30 percent of the pegmatite (Smith and Page, 1941).

Fremont County

8. Rock Creek gold mine
S1/2 secs 20, 21, and 22, and N1/2 secs 27, 28, and 29, T.30N, R.100W

Small flakes of phlogopite mica 1/16 to 1/8 inch in diameter are found in a Precambrian schist that contains native gold. In the early 1950s, the operators of the mine planned to recover the phlogopite and sell the mica as a by-product from the gold mining operation. Ten tons of mica per day was the planned production rate (Wilson, 1953). However, there are no records of the sale of mica from this area.

9. Bonneville#8, (Whippet #8)
SW1/4, SW1/4, SW1/4 sec. 22, and NW1/4, NW1/4, NW1/4 sec. 27, T.40N, R.93W

Large books of muscovite mica occur in a quartz-feldspar pegmatite at this locality (Chatman, 1989, Hanley and others, 1950). This pegmatite also contains beryl and columbium-tantalum minerals (Chatman, 1989, Harris, 1987). [See also Harris and King (1987) for information about the mineralogy of this and other pegmatites in the area.]

10. Arm, Pole Creek, and Gray Ghost claims
Secs. 19, 20, 29, 30, and 31, T.43N, R.104W, and secs. 23, 24, and, 25, T.43N, R.105W

Ely (1971) describes several quartz-feldspar-mica pegmatites in this area. The quantities of mica in the pegmatites are said to be "small rather than large". However, the pegmatites are of large size, and mica was not the focus of the study.

11. Southern Wind River Range
T.28 and 29 N, R.97, 98, 99, 100, 101, and 102W

Proctor and El-Etr (1968) described muscovite-bearing pegmatites in this area of the southern Wind River Range, which includes the South Pass and Atlantic City mining districts. Muscovite is the most common mineral in a few of these pegmatites, and in some zones of other pegmatites. No estimate is given of the grade and resource of muscovite in this area.

Goshen County

12 - 18. Haystack Hills area

The Haystack Hills are located on the western border of Goshen County in T. 27, 28 and 29 N., R. 65W. The Precambrian rocks exposed in this area contain a number of mica-bearing pegmatites and include the historically most important production of mica in Wyoming. The largest of these prospects were the Crystal Palace (Torrington), Savage (Torrington #3), New York, Chicago, and Minnie (Eagle). Other claims in the area (T. 28 N., R. 65 W.) were named the Silver Bow, Jerry (no.s 1 - 8), Toots and Snookie, Dickey Boy (no.s 1 - 6), White Star, Denver (Torrington #1), Charm, Ruth, Reward, Bore, Pierce, Profit, Poke, and Buffalo (Hanley and others, 1950). For a map of the claim locations, see Hanley and others (1950). This report summarizes only the larger prospects in the district.

12. Crystal Palace (Torrington)
NE1/4 sec. 34, T.28N, R.65W

This prospect was developed as an open cut along a muscovite-bearing pegmatite by Lauck & Stein in the 1910s (Ball, 1907). Lauck & Stein were two early prospectors in the Hartville uplift area. The ruins of their dwelling are still present about 2 miles west of this prospect (Barbara Costopoulos, Guernsey, Wyoming, personal communication, 1989). Some early settlers of the area remember mining operations at the Crystal Palace in the years before World War II (John Harvey and Richard Rush, Guernsey, Wyoming, and Steve Caligiore, Hartville, Wyoming, personal communication, 1988).

The open cut at the Crystal Palace is about 60 feet long and about 35 feet deep. The pegmatite has been almost completely mined out of this cut, and is not exposed on either the hanging wall or the footwall. To the north of the open cut, a continuation of this pegmatite extends into the valley wall, and strikes about N60°E. According to a report in the Geological Survey of Wyoming files (anonymous, 1923), the pegmatite extends "for some distance" to the southwest. Examination by the author of this report discovered no outcrop of the pegmatite southwest of the cut. This area is covered with talus, boulders, and other debris from the hills to the east. In 1985, a forest fire cleared part of the area, affording a better exposure of the pegmatite northeast of the cut.

The pegmatite is coarse textured and consists of feldspar, white quartz, muscovite, black tourmaline, brown garnet, and a little beryl (Ball, 1907). Bogs (books) were found in sheets larger than 3 inches by 4 inches in size (anonymous, 1923). Examination of the prospect by the author verified the presence of the minerals listed above, with the exception of beryl. A small dump of mica at the mouth of the cut contains muscovite sheets up to about 4 inches by 5 inches. About 3 tons of scrap and flake mica are present in this dump. The foundation of a wagon-loading structure is present in the draw just below (west) of the small dump.

From the size of the cut, this is the largest mica prospect in the Haystack Hills. Muscovite resources are present in the extension of the pegmatite to the northeast and to the southwest. If the muscovite comprises about 10% of the rock mass (anonymous, 1923), there are over 8 tons of scrap and flake mica present in exposed pegmatites, with more possibly present to the northeast, beneath the hill.

13. Savage claim (Torrington #3)
Near the center, S1/2 sec. 26, T.28N, R.65W

This claim was discovered by Lauck & Stein, the first operators of the Crystal Palace (see Crystal Palace). This prospect consists of a small open cut on a pegmatite that strikes N25°E. The pegmatite was reported to be 10 feet wide and to extend 200 feet southwest of the cut. Muscovite, sometimes occurring in sheets 11 inches by 13 inches was produced from this prospect. Other minerals include feldspar, white quartz, and beryl, which here is reported to be bluish green (Ball, 1907). An examination of this prospect by the author of this report confirms the presence of the minerals reported by Ball (1907). The beryl is translucent to cloudy, and blue-green to green in color.

14. New York claim
NE1/4 NE1/4 sec. 35, T.28N, R.65W

This prospect was developed in the early 1900s by Mr. George Frederick, whose abandoned ranch, store, and post office are located in Whalen Canyon in sec. 27, T. T.28N, R.65W. The pegmatite is 6 to 10 feet wide in the open cut. It narrows to 5 feet 350 feet west of the cut, and widens to 50 feet another 500 feet west. Muscovite occurs in this pegmatite in plates up to 20 inches in diameter. Some of the larger plates are ruled (have parallel striations or kinks in the crystal structure). The largest unruled plates were 6 to 8 inches in diameter (Ball, 1907).

15. Minnie claim (Eagle)
Just southwest of the center of sec. 35. T.28N, R.65W

This prospect was developed by George Frederick (see New York claim above.) Ball (1907) reports sheets of mica up to 8 inches in diameter in a pegmatite at this locality.

16. Chicago prospect
SW1/4, NE1/4 and SE1/4, NW1/4 Sec. 35, T.28N, R.65W

The Chicago prospect was developed by a 55- by 8-foot open cut varying from 4 to 6 inches deep. The pegmatite at this locality is poorly zoned, with a quartz-microcline core and a border zone that contains quartz, muscovite, plagioclase, and black tourmaline. The muscovite occurs in books as large as 9 by 18 inches; it is not greatly ruled and is not distorted. It is estimated to compose 5 to 10 percent of the pegmatite (Hanley and others, 1950).

17. Ruth claim
SE1/4 sec. 35, T.28N, R.65W

Muscovite plates 8 inches in diameter were reported by Ball (1907) at this locality. Hanley and others (1950) report that an oval pegmatite 155 feet by 80 feet in plan is found on this claim. The pegmatite is irregularly zoned, and contains beryl in a zone that also contains quartz and muscovite. Hanley and others (1950), reported that the recovery of mica would be quite low.

18. Unnamed prospect
Center N1/2, sec. 35, T.28N, R.65W

Ball (1907) reported plates of mica up to 10 inches in diameter in a pegmatite at this locality. Beryl crystals up to 4 feet long were also reported by Ball (1907) in this dike.

Natrona County

19. Casper Mountain area (Koch's Feldspar)
Secs. 17, 18, 19, and 20, T.32N. R.79W

A massive white pegmatite at this locality contains large books of muscovite mica. Muscovite occurs locally in large sunburst-like masses (Gable and others, 1988). Some pegmatites in this area, where enclosed by serpentinite, contain mica books that are colored similar to phlogopite, but the mineralogy of this mica has not been conclusively determined (Burford and others, 1979)

Hagner (1942c) reported that a quartz-feldspar-muscovite pegmatite, called Koch's feldspar is found at this locality. The property was worked for feldspar. Muscovite is said to be a fairly common constituent of the pegmatite (Hagner, 1942c).

20. Casper Mountain area
NE1/4 NW1/4 sec. 13, T.32N, R.80W

A white pegmatite dike that cuts a pink pegmatite dike at this location contains muscovite as the most common accessory mineral (Burford and others, 1979).

Platte County (?)

21. Guernsey area

In 1929 or 1930, a company called Western Mineral Products opened a mica mine in a pegmatite "near Guernsey" (Osterwald and others, 1966). This locality could be near the center of sec. 25, T. 27N., R. 66W., where there is a small prospect in a pegmatite dike, or this reference could be to the Haystack Hills area in Goshen County, about 8 miles from Guernsey. The pegmatitie in sec. 25 contains only small amounts of mica and the largest crystals there are 1 inch x 1 inch x 1/8 inch.

Platte County (or Albany County)

22. Mica Hill Mining Company prospect
20 miles west of Wheatland in the Laramie Mountains

A quartz-feldspar pegmatite is reported (anonymous, undated) to contain warped and jointed muscovite. The pegmatite is 1000 feet long, and contains 15 to 20 percent muscovite. A mica schist that forms the country rock for the pegmatite contains up to 50 percent mica. It is not stated whether this schist contains muscovite or other kinds of mica.

Sweetwater County

23. Leucite Hills
T.21,22, and 23N., R.101 to 103W.

Copper-colored phlogopite mica is an important constituent of some of the alkalic, potash-rich lavas, cinders, pumice, and other volcanic rocks of the Leucite Hills. This mica has a potential of by-product production from crushed or ground volcanic rock used for aggregate or potash production. Due to its unusual and bright coloration, this phlogopite has the potential to be used for colored additives to paint and decorative tile, facing, precast concrete, roofing tile, and others.

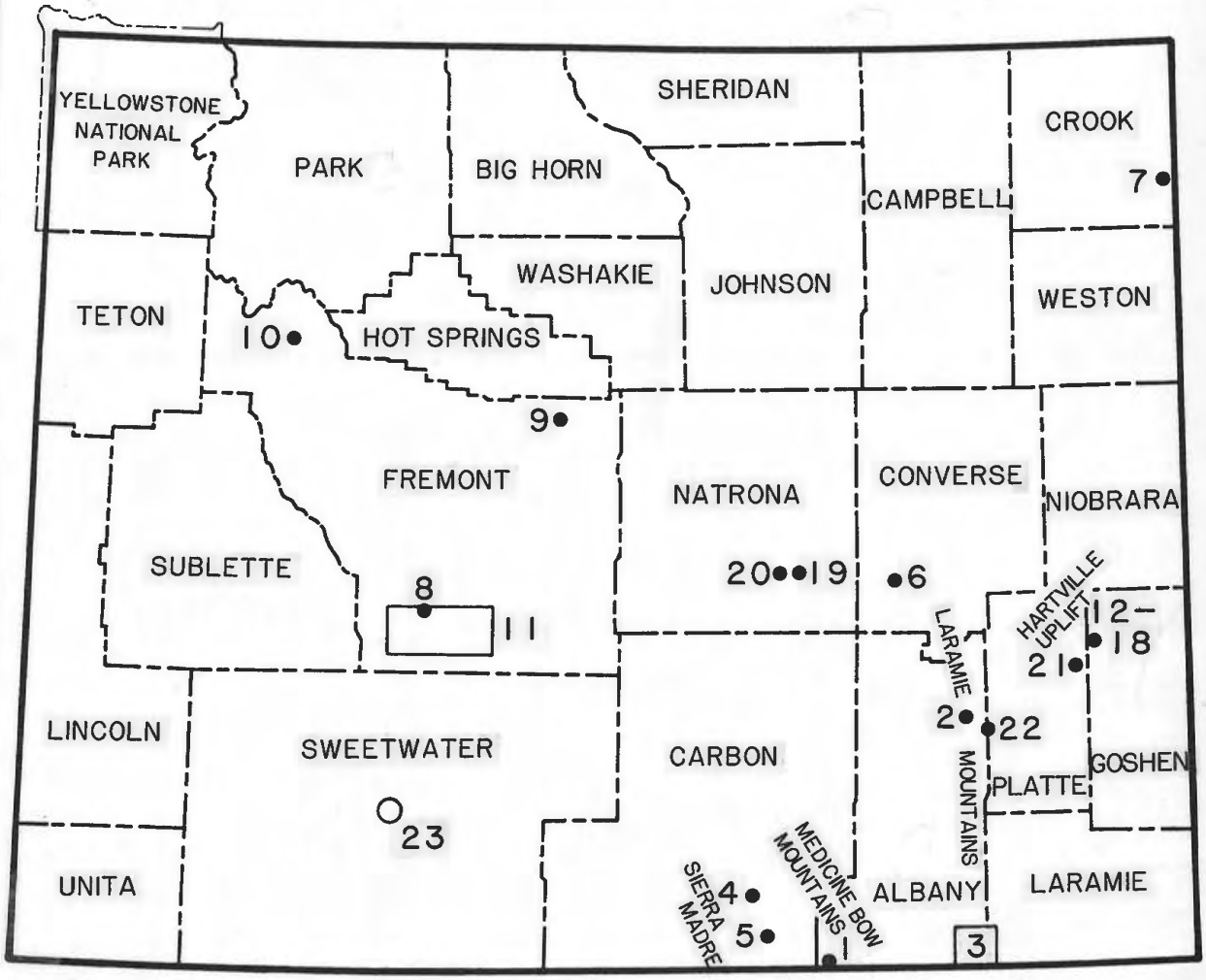

Figure 1. Index map showing the location of mica occurrences in Wyoming.

References cited

Ball, S. H., 1907, Mica in the Hartville uplift, Wyoming: U. S. Geological Survey Bulletin 315, p. 423 - 425.

Beckwith, R. H., 1937, The geology of the Muscovite and Ione mining claims: Geological Survey of Wyoming unpublished Mineral Reports, MR 37-3 and 37-1, 5p.

Burford, A. E., Corbett, R. G., Franks, P. C., Friberg, LaV. M., Lorson, R. C., Marsek, F. A., Nanna, R. F., Schumacher, J. C., and Wymer, R. C., 1979, Precambrian complex of Casper Mountain, Wyoming -- A preliminary paper: Wyoming Geological Association Earth Science Bulletin, v. 12, no. 2, p. 58 -69.

Chapman, G. P. , 1983, Mica, *in* Lefond, S. J. Editor, Industrial minerals and rocks, 5th edition: The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., Baltimore, Maryland, v.2, p. 915 - 929.

Chatman, M. L., 1989, Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming--a preliminary report: U. S. Bureau of Mines Open-File Report 15-89, 72p.

Davis, L. L., 1989, Mica (natural) sheet: U. S. Bureau of Mines Mineral Commodity Summaries, 1989, p.106 - 107.

Davis, L. L. , 1989, Mica (natural), scrap and flake: U. S. Bureau of Mines Mineral Commodity Summaries, 1989, p. 104 - 105.

Ely, J. P., II, 1971, Mineral possibilities of the Arm, Pole Creek, and Gray Ghost claim groups--Fremont County, Wyoming: Geological Survey of Wyoming unpublished Mineral Report 71-2, 5p.

Gable, D. J., Burford, A. E. , and Corbett, R. G., 1988, The Precambrian geology of Casper Mountain, Natrona County, Wyoming: U. S. Geological Survey Professional Paper 1460, 50p.

George, R. A., 1942, untitled, *in* Hagner, A. F., Jasper mine (copper), Douglas district: Geological Survey of Wyoming unpublished Mineral Report 42-7, 1p.

Gwinn, G. R., 1951, Domestic mica: U. S. Bureau of Mines Information Circular 7617, 37 p.

Hagner, A. F., 1942a, George-Funk mica: Geological Survey of Wyoming unpublished Mineral Report 42-22, 1p.

Hagner, A. F., 1942b, Funk mica: Geological Survey of Wyoming unpublished Mineral Report 42-21, 1p.

Hagner,A. F., 1942c, Koch's feldspar: Geological Survey of Wyoming unpublished Mineral Report 42-10, 1p.

Hagner, A. F., 1943, Big Chief mica deposit: Geological Survey of Wyoming unpublished Mineral Report 43-12, 1p.

Hanley, J. B., Heinrich, E. W., and Page, L. R., 1950, Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U. S. Geological Survey Professional Paper 227, 125p.

Harris, R. E., 1987, The Bonneville pegmatite claims, Copper Mountain, Fremont County, Wyoming: Geological Survey of Wyoming unpublished Mineral Report 87-1, 6p.

Harris, R. E., and Hausel, W. D., 1986, Wyoming pegmatites, *in*, Modreski, P. J., editor, Colorado Pegmatites Symposium Volume: Colorado Chapter, Friends of Mineralogy, p. 101 - 108.

Harris, R. E., and King, J. K., 1987, Columbium (niobium) and tantalum in Wyoming: Geological Survey of Wyoming Open File Report 87-6, 22p.

Hoag, E. C., 1927, unpublished letter to T. Joe Cahill, Wyoming Department of Commerce and Industry: Union Pacific Railroad Department of Traffic, 3p.

Houston, R. S., 1961, The Big Creek pegmatite area, Carbon County, Wyoming: Geological Survey of Wyoming Preliminary Report 1, 11p.

Osterwald, F. W., Osterwald, D. B., Long, J. S., Jr., and Wilson, W. H (revised by W. H. Wilson), 1966, Mineral resources of Wyoming: Geological Survey of Wyoming Bulletin 50, 287p.

Proctor, P. D., and El-Etr, H. A., 1968, Layered pegmatites, southern Wind River Mountains, Fremont County, Wyoming: Economic Geology, v. 63, p. 595 - 611.

Smith, R. W., 1953, Preliminary examination of feldspar property, Mormon Canyon area: U. S. Atomic Energy Commission Preliminary Reconnaissance Report, 1p.

Smith, W. C., and Page, L. R., 1941, Tin-bearing pegmatites of the Tinton district, Lawrence County, South Dakota--a preliminary report: U. S. Geological Survey Bulletin 922K, p. 595 - 630.

Anonymous, undated, Mica Hill Mining Co.,Sunrise Mica, and Encampment Mica: Geological Survey of Wyoming unpublished Mineral Report, 3p.